DOCUMENT RESUME

ED 397 779 IR 017 967

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TITLE A Door Is a Big Wooden Thing with a Knob: Getting a Handle on Metaphorical Interface Design.
PUB DATE 96
NOTE 10p.; In: Proceedings of Selected Research and Development Presentations at the 1996 National Convention of the Association for Educational Communications and Technology (18th, Indianapolis, IN, 1996); see IR 017 960.
PUB TYPE Reports - Descriptive (141) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Computer Assisted Instruction; *Computer Software Development; Grade 9; High Schools; Instructional Materials; Literary Criticism; *Metaphors; Models; Poetry; Reading Skills
IDENTIFIERS *Graphical User Interfaces; Interactive Systems; Lehigh University PA; Navigation (Information Systems); *Poe (Edgar Allan)

ABSTRACT

This paper chronicles the evolution of a metaphorical graphical user interface (MGUI) at Lehigh University (Pennsylvania). From its inception, "The Funeral of Edgar" has been a guided exploration of Edgar Allan Poe's poem, "The Raven," aimed at modeling high school students' critical and analytical reading skills. This product is targeted for the 9th grade student enrolled in an English class with limited exposure to literature. In the initial interface, which was graphical but non-metaphorical, four resources were represented by four books on a shelf: the poem, a dictionary, a biography, and Poe's essay on "The Philosophy of Composition." Poe's preoccupation with the macabre and the poem's overriding death theme suggested a cemetery primary metaphor in which learners might explore a variety of objects and characters. A main screen filled with "clickable" objects and characters was employed as a way of eliminating the need for confounding navigational devices. The Immersive MGUI (the most metaphorical of the GUIs) required adding a third dimension--one that created an interactive environment for the user. Thus, the first step toward implementing an immersive MGUI was to create a scenario in which the learner would take on the role of the cemetery's caretaker. In addition to changes in the scenario, other general changes were made to the interface in order to make it more immersive. (Contains 16 references and 8 figures.) (AEF)

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Title:

A Door Is a Big Wooden Thing with a Knob: Getting a Handle on Metaphorical Interface Design

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IR 017967

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In 1986, while considering the design of human-computer interfaces, Laurel wondered what the ideal user experience might be and what sort of interface might provide it. Now, ten years later, a quick market survey might well lead one to believe that the answer to Laurel's question is the Graphical User Interface (GUI). Buttons have almost completely replaced function keys. Icons represent everything from objects to actions. Once considered extravagant, high resolution color graphics and mice are now essential. GUIs have become increasingly prevalent across all operating platforms. Despite the prevalence of GUIs, however, some users still find it difficult to operate their computers. It may be that simply employing visual representations in the interface is not enough; to realize the ideal user experience, it may be necessary to employ metaphors in interface design.

This paper chronicles the evolution of a metaphorical graphical user interface (MGUI). This particular project has been a part of the author's involvement with the Design and Development Group at Lehigh University.

What are MGUIs and Why Do We Need Them?

To understand MGUIs, one must first understand metaphors. The Oxford Encyclopedic English Dictionary (1991) defines metaphor as "the application of a name or descriptive term or phrase to an object or action to which it is imaginatively but not literally applicable." Erickson (1990) defined a metaphor as "an invisible web of terms and associations that underlies the way we speak and think about a concept" (p. 66). Mountford (1990) took this definition one step further contending that "metaphors are powerful verbal and semantic tools for conveying both superficial and deep similarities between familiar and novel situations" (p. 25). Indeed, metaphors frequently appear in both our speech and writing.

A GUI's use of metaphor is, however, more likely to be implemented visually. Despite the above definitions' failure to mention *visual* representations of an object or action to which it is imaginatively — but not literally applicable — a quick stroll through your neighborhood airport with its iconic signage should provide sufficient evidence of the prevalence of visual metaphors. In fact, visual metaphors are currently used in computer interfaces: papers, stacks, folders, directories, menus, trees, and trash cans — all generally familiar images — are manipulated on a desktop to carry out the basic operations of computers. These metaphors can be useful and efficient because they represent ways of conceptualizing these computer functions and, as Erickson (1990) argued, bring along "additional bits of structure that may be useful later on" (p. 72). And, as anyone who has been hesitant before dropping his or her file-laden diskette into Apple's trash can will tell you, these lingering bits of structure do indeed exist. In fact, because of this phenomenon, many designers have warned that the inappropriate use of metaphors can cause confusion, misunderstanding, and both navigational and conceptual difficulties for your user (Rosendahl-Kreitman, 1990; Semper, 1990; Vertelney, Arent, and Lieberman, 1990).

Assuming for now, however, that we can identify appropriate metaphors, the benefits MGUIs might offer computerized instruction are twofold: First, because metaphors help one establish expectations for how things should work (Black, 1979), MGUIs might help a student establish expectations for how an instructional software product should work. As is the case with basic computer operations within a MGUI environment where moving an electronic file is as easy as dragging and dropping its paper representation onto a folder, MGUI environments can be used to help students quickly learn the basic functional and navigational operations of an instructional application. Second, and more importantly for instructional design, because metaphors facilitate "understanding and experiencing one kind of thing in terms of another" (Lakoff & Johnson, 1980, p. 5), MGUIs might also facilitate the understanding and experiencing of new and abstract concepts in terms of other more familiar concepts or experiences. As has long been the case in good teaching where educators use a student's existing knowledge to help explain new curricular materials (Coker, White, & Barton, 1993), MGUI environments can be designed to help students learn content by providing "both superficial and deep similarities between familiar and novel situations" (Mountford, 1990, p. 25).

How do we keep the MGUI from becoming, as Nelson (1990) argued, "a dead weight," especially when an interactive multimedia learning environment's primary purpose is to teach? Supplying support for learner inquiries does not have to mean that the environment must be boring or limited; as we know, there is certainly an instructional need to gain attention and to motivate. What this does mean is that everything in the instructional product must contribute to the goal of helping learners acquire new knowledge and skills. This goal easily can get lost within a metaphor as its implementation grows in complexity. It is the instructional designer's task is to assure this does not happen.

One final note before we leave this section. The defining characteristic of a metaphor is that it compares one thing to another without directly stating the comparison (Cates, 1993). For example, a door might be metaphorically compared to an opportunity or a juncture with no additional explanation as to why or how they are similar. In this way, a metaphor is a statement of relation, not simply a statement of fact. Thus, to report that "a door is a big wooden thing

with a knob on it" is simply definitional, not metaphorical. Although this clarification may seem obvious, many of us have discovered that creating a metaphor is much more difficult than spotting one. In fact, this catch-phrase has become a warning among the designers in Lehigh's Design and Development Group to alert us to GUIs treading dangerously close to non-metaphoricality.

Defining the Content

From its inception, "The Funeral of Edgar" has been a guided exploration of Edgar Allan Poe's poem, "The Raven," aimed at modeling high school students' critical and analytical reading skills. This product is targeted for the 9th-grade student (roughly 14-15 years old) enrolled in an English class with limited previous exposure to literature and even less experience with poetry. This is the kid who is "psyched" to find that her English homework for the evening consists of a two-page poem which she knows she can read in less than 30 seconds. This "MTV" approach to critical reading usually ends up with the student entirely missing the poem's meaning — bypassing parenthetical background information the textbook's publishers have so carefully added, glossing over images the poet has carefully chosen, and failing to reflect on ways their own life experiences are mirrored in the poem's themes. Although the next morning's class discussion may help in understanding the teacher's perspective, the student rarely learns how to read analytically or how to develop independent ideas.

It appears that teaching careful and analytical reading may be more difficult without first actually showing the student how it is done at the same time that the student reads (Vygotsky, 1987). Unfortunately, given class sizes and time constraints, it is almost impossible for a teacher to demonstrate critical reading techniques by guiding each student through his or her first readings. However, this kind of modeling might be possible from within a computerized lesson programmed to guide and coach each student actively through the reading assignment. For this reason "The Funeral of Edgar" is based on a guided exploration approach: although students are free to "roam," the application mediates the student's experience by providing content-sensitive help, asking questions at appropriate times, directing attention to anomalies, suggesting avenues of further investigation, calling attention to overlooked information, helping to organize the reader's thoughts, and supporting the synthesis of new concepts and schemas.

The Initial Interface

Edgar Allan Poe's "The Raven" was chosen for this application because of its reputation as a favorite among students within this age group and because the poem's vocabulary is relatively accessible and its images few. "The Raven" also addresses topics which describe the human condition — lost love, untimely death, human perspective — literary subjects which Judy (1980) argued are appropriate for this grade level. In addition, the poem's supernaturally gothic tone provides an array of metaphorical opportunities to help learner's acquire critical reading skills. Finally, Poe's "The Philosophy of Composition," a step-by-step discussion which vividly demonstrates Poe's deliberate word and image choices in "The Raven," provides a unique opportunity for students to explore the author's creative process while simultaneously exploring the creation. The essay, which describes how poets fabricate their work from images selected for consciously determined purposes, serves as a "scaffold" for exploring "The Raven."

Okay. Now the truth. While "The Raven" did, in fact, fit all the above criteria, it would be less than candid not to admit that it also fit nicely into the bookshelf metaphor which a coding approach to the content suggested. One of the instructional goals for this product is that students learn to use external resources for deciphering the multiple meanings of words in a poem. "The Philosophy of Composition" nicely rounded out the bookshelf collection: a dictionary for allowing students to look up words, a biography for allowing students to read about Poe's life, a copy of the essay so student's could learn about the creative process, and the poem itself. Figure 1 depicts one of the screens from this early design.

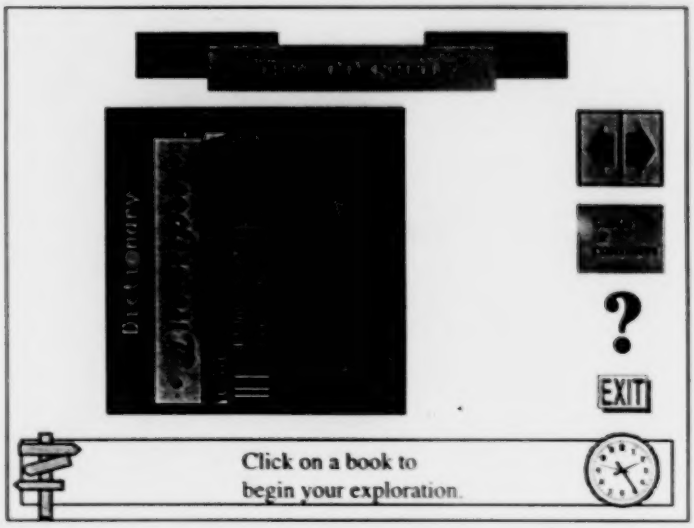

FIGURE 1: The initial interface.

Although this interface is graphical, because it did not represent one thing in terms of something else different, it was in no way metaphorical. This type of design is a Graphical but Non-Metaphorical Interface (GNUI) and is at the lowest end of metaphorical interface design (Cates, 1996). A door is a big wooden thing with a knob on it.

First Attempt to Make the Interface Metaphorical

As Figure 1 shows, in the project's early design, the four resources were represented by the four books on the shelf. The table of contents and bookshelf screens were to be accessible by clicking on miniaturized versions in the navigation strip along the right side of the screen. Navigation functions were represented by the right/left arrow buttons. A map of the entire application was available by clicking on the sign post at the lower left. Although arrow buttons and sign posts have nothing to do with bookshelves, confounding screen devices like these became necessary as it became apparent how difficult this bookshelf interface would be to implement. How would learners pull books off the shelf? Pointing and clicking seemed unnatural. How would pages turn? There are no buttons on real book's pages. How could the program be less passive? With the exception of some workbooks, there is little interactivity with a book. In this way, because of the inadequacy of the bookshelf metaphor, the initial interface quickly moved from a GNUI to a Mixed Metaphorical Graphical User Interface (Mixed MGUI) — one which employs an underlying metaphor, but employs a variety of auxiliary metaphors that are confounding. What the project needed was a stronger primary metaphor.

On the basis of Mac Cormac (1985), Mountford (1990), and Black's (1979) discussions of metaphor operation, one may divide metaphors into two classes: primary (or underlying) metaphors and secondary (or auxiliary) metaphors. A primary metaphor is the principle or first metaphor employed and secondary metaphors is a subsequent metaphor employed by the product (Cates, 1994). The primary metaphor establishes the general context into which the secondary metaphor must fit.

Poe's preoccupation with the macabre and the poem's overriding death theme suggested a cemetery primary metaphor in which learners might explore a variety of objects and characters. A main screen filled with objects and characters upon which the learner clicked might eliminate all need for confounding navigational devices. In addition, if the metaphor were actually *Poe's* fictional funeral, it would be possible to have his ghost deliver excerpts from "The Philosophy of Composition" rather than to make students trudge through its somewhat heavy-handed prose. Having Poe's spirit "speak" directly to the students from the grave about his creative process while they read the poem might help them understand the process better. Twin brothers could eulogize the poet by having one read from the poem while the other added personal anecdotes and interpretations. Figure 2 shows the main screen from this first MGUI attempt.

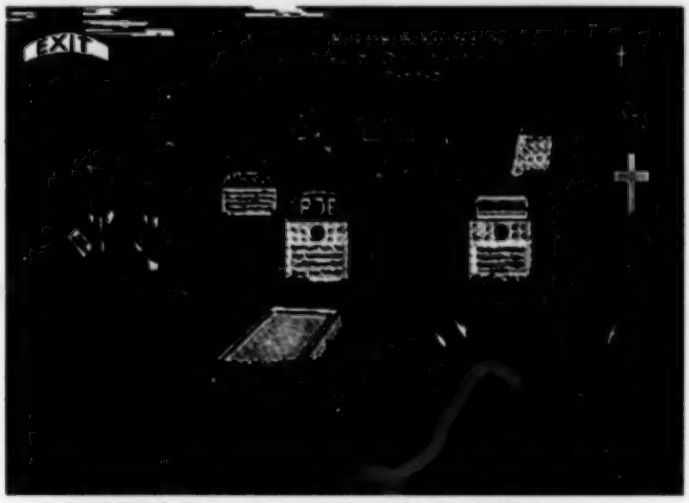

FIGURE 2: The main screen from the first MGUI attempt.

This screen depicted several objects and characters upon which learners' clicked to "zoom in" and learn pieces of background information about the poem. For example, when learners clicked on Poe's open grave his ghost appeared and briefly outlined the "Philosophy of Composition." When learners clicked on the caretaker, always available to provide help, he gave dynamic suggestions on where to click next. When learners clicked on a tombstone marked "Edgar" their perspective moved in close enough to see its engraving of Poe, his dates of birth and death, and other brief details about his life. When learners clicked on a second tombstone next to Poe's marked "Virginia," his wife described their love and her untimely death. Other objects included a statue of Pallas Athena (Greek goddess of wisdom who briefly described her story and Poe's fascination with "forgotten lore"), a raven in a tree (who said only "Nevermore"), and a suspicious-looking character peering from behind a bush (one of Poe's critics who discussed his views).

After the learner had explored all these objects, the twin mourners arrived to do the eulogy. While they spoke in the "foreground," Poe's ghost occasionally floated through the background dropping roses (taken from the fact that someone leaves a rose at Poe's grave in Baltimore every year on the anniversary of Poe's birthday). When the learner clicked on these roses, the caretaker was replaced by Poe's ghost who provided excerpts from "The Philosophy of Composition" pertinent to the stanza being covered at that time by the twins (see Figure 3).

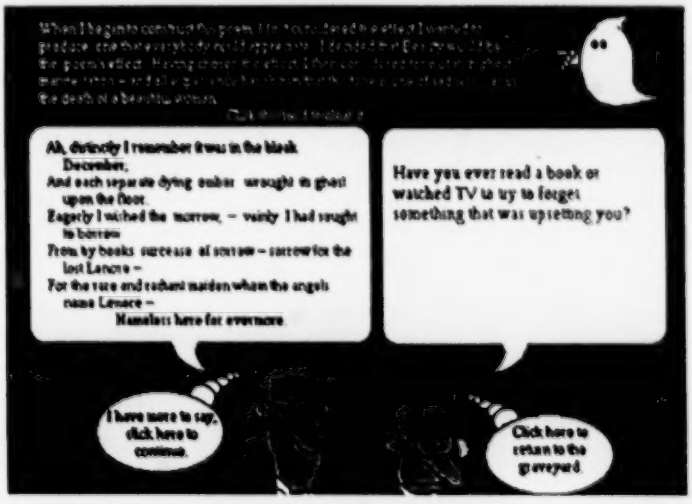
Have you ever read a book or watched TV to try to forget something that was upsetting you?
I have more to say, click here to continue.
Click here to return to the graveyard

FIGURE 3: The "eulogy" screen.

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The cemetery metaphor lent itself to producing a lesson that was likely to be much more interesting and infinitely more entertaining than the bookshelf version would have been. The primary metaphor had established the general context into which all of the secondary metaphors fit. All of the images used were consonant with the cemetery theme and enhanced the metaphor's believability and efficacy. However, the application was still primarily just a "point-and-click" exercise. Learners using this product were barely more involved in this interface than they would have been with the bookshelf. Consequently, this design fell into the third group on the metaphorical interface design continuum, a Thematic Metaphorical Graphical User Interface (Thematic MGUI — Cates, 1996). A door is a hinged, sliding, or revolving barrier for closing and opening an entrance — with a knob on it. Back to the drawing board.

Implementing an Immersive MGUI

Although thematic GUIs may enhance believability and predictability of the application, they tend to be somewhat flat. In this case, all interaction with the program had become simple back-and-forth navigation zooming in and away from objects on the screen. Moving to the most metaphorical of the graphical user interfaces, the Immersive MGUI, requires adding a third dimension — one that creates an interactive environment for the user. Thus, the first step toward implementing an immersive MGUI was to create a scenario in which the application could become more interactive — by requiring learners to take on the role of the cemetery's caretaker rather than be just passive observers as had been the case in the application's thematic GUI version. In order to get the learners involved in their immersive role as quickly as possible, the application opens with an angry funeral director asking where the learner has been while preparations for the Poe funeral should have been made.

In addition to changes in the scenario, it was necessary to make some other general changes to the interface in order to make it more immersive. For example, to draw learners into the poem's supernaturally gothic tone and increase the interface's three-dimensional feel, grim photographic graphics were chosen to replace the more cartoon-like graphics that had been used in the thematic GUI version. Figure 4 shows the changes that have been made to the main screen.

FIGURE 4: Main screen from which all exploration begins.

In addition to setting up the scenario for increased learner involvement, the brooding funeral director enhances the immersive MGUI's foreboding mood by replacing the smiling caretaker that had been a large part of the earlier version.

Three-dimensional objects and enhanced manipulatability are key components of immersive MGUIs. To make "The Funeral of Edgar" interface more interactive, manipulatable objects such as an obituary page, flowers, and charcoal (for stone rubbings) were added. Instead of simply pointing and clicking at these objects, as had been the case with the thematic GUI, objects within the new, more immersive GUI are dragged and dropped. Figure 5 shows a screen in which users learn more about the poet by reading the cards enclosed with flowers left for the deceased.

FIGURE 5: Card reading screen.

Rather than simply pointing and clicking on the flowers to get a "blown up" version of the card, learners must actually "pull" the card out of the envelope by dragging it out and dropping it. Changes in the cursor from a "pointer" hand, to a "grabbing" hand, to a "go back" hand enhance the realism of these manipulations and make it possible to navigate while minimizing cumbersome and intrusive mouse clicks (see figures 6-8).

FIGURE 6: Pointer cursor indicates manipulatable object.

FIGURE 7: Grabbing hand indicates draggable object.

FIGURE 8: "Go back" hand provides means to restore full screen.

To establish the feel of a larger "virtual" world and to eliminate the need for an extensive navigation scheme, the application was programmed so that the screen is literally a small window on an interface that spans three screen widths. When learners click on the left or right side of the screen, the program pans left and right across the interface. Small free-standing directional signs, like the ones which might be found in a cemetery to direct visitors, are positioned in the lower left and right corners of the screen to indicate this functionality.

Cates (1994) suggested that "properties, operations, phrases, images, and types associated with the primary metaphor may provide the imaginal and semantic links" to related, secondary metaphors (p. 3). The primary funeral metaphor lends itself to many secondary metaphors: flowers, mourners, tombstones, graves, epitaphs, caskets, ghosts, eulogies, and seances. These devices are used to provide content- and context-sensitive help, introduce historical background, produce Poe's poetic philosophy, and deliver the poem itself. As before, students gather information pertinent to the poem from the various characters and objects by clicking on them. As learners explore each of these objects, time passes on the sundial eventually triggering events like the arrival of the casket and flowers, the burial ceremony, and the seance. Before exiting the program learners pass through a "field" of grave markers where they see that

the program has "marked" their place before exiting with an epitaph like "Here lies <student's name>. . . we look forward to his next coming."

Provided one does a good job selecting secondary metaphors, choosing a primary metaphor might appear at first to be a somewhat arbitrary decision. In the thematic MGUI version of "The Funeral of Edgar," the primary cemetery metaphor was generally location-based. Although location-based metaphors may lend themselves to teaching static materials which the learner needs to memorize, the cemetery metaphor left few alternatives for segmenting the complex content that needed to be covered. Consequently, screens like the "eulogy screen" depicted in Figure 3 became overloaded. In contrast, the new version of the lesson relies on a funeral as its primary metaphor; a subtle shift that proved to be a major factor toward making its MGUI more immersive. This change allowed the lesson's content to be metaphorically divided by time: in the period before the funeral learners interact with screen objects to learn background information about the poet and about images used in the poem; during the funeral learners interact with characters to learn more about how differently individuals interpret events; after the funeral students learn that a poem's text includes words that have multiple "layers" of significance to its overall theme.

Concluding Remarks

Thus, "The Funeral of Edgar" evolved slowly from a GNUI to an immersive MGUI in the hope that its audience will feel a greater sense of believability and involvement, which might lead to better comprehension (Cates, 1996). Granted, many 14- to 15-year-old students will not have personal experience with funerals. However, their knowledge of a graveyard's visual, functional, and emotive properties (from television, movies, and books) should be sufficient for the primary and secondary metaphors to operate. In addition, these learners will be familiar with asking others for information (as opposed to consulting reference materials) and with various computer and video games that utilize similar exploration formats.

So, a door is an opportunity and a gate is something you use to get into a cemetery — but don't expect that to be all that there is to it.

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